

**WHAT IS CLAIMED AS THE INVENTION IS:**

1. An automatic sample loader for use in association with a mass spectrometer and at least one vial containing a sample, the loader comprising:
- 5           a vial block having at least one vial cavity, each vial cavity adapted to receive a vial;
- an insertion head adapted to be sealingly engageable in the vial cavity;
- an insertion tube operably connected to the mass spectrometer through the insertion head, such that the tube extends into the vial when the insertion head is
- 10   sealingly engaged in the vial cavity;
- a means for pushing the sample out of the vial and into the tube;
- and a means for moving the insertion head relative to the vial block from an engaged position to a disengaged position.
- 15   2. An automatic sample loader as claimed in claim 1 wherein there are a plurality of vial cavities in the vial block and further including a means for advancing the vial block relative to the insertion head.
3. An automatic sample loader as claimed in claim 2 further including a two degree of
- 20   freedom linear positioning stage and wherein the vial block is positioned in the positioning stage and movement of the positioning stage moves the vial block relative to the insertion head.
4. An automatic sample loader as claimed in claim 3 wherein each vial cavity includes
- 25   a liftable lid and each lid is adapted to be lifted prior to moving into the engaged position.

5. An automatic sample loader as claimed in claim 3 wherein the insertion head includes a plurality of pressure ports and the insertion tube is connected through one of the plurality of pressure ports and the insertion tube extends into the vial when in the engaged position.

6. An automatic sample loader as claimed in claim 5 further including a waste tube which extends through another of the plurality of pressure ports in the insertion head.

7. An automatic sample loader as claimed in claim 6 further including a compressed gas tube which extends through another of the plurality of pressure ports in the insertion head whereby gas is pushed into the vial through the compressed gas tube and the contents of the vial are pushed into the insertion tube thus providing means for pushing the sample out of the vial.

8. An automatic sample loader as claimed in claim 7 further including a sensor.

9. An automatic sample loader as claimed in claim 8 wherein the sensor includes a first electrode extendable into the vial and a second electrode and wherein an impedance measure therebetween provides an indication of the amount of sample in the vial.

10. An automatic sample loader as claimed in claim 9 further including a waste removal electrode connected to waste tube.

11. An automatic sample loader as claimed in claim 10 further including a three degree

of freedom adjustment stage adapted to support a mass spectrometer column which is operably connected to the mass spectrometer.

12. A method of loading a sample for a mass spectrometer comprising the steps of:
- 5       advancing a vial cavity having a vial with a sample therein into a predetermined position relative to an insertion head;
- lowering the insertion head into the vial cavity;
- coupling the insertion head into the vial cavity;
- applying pressure to the vial cavity whereby the sample is drawn into the
- 10   insertion head;
- de-coupling the insertion head from the vial cavity.

13. A method of loading as claimed in claim 12 further including the step of determining if the vial is empty.
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14. A method of loading as claimed in claim 13 further including the step of applying a buffer to the vial.

15. A method of loading as claimed in claim 14 further including the step of removing
- 20   waste.

16. A method of loading as claimed in claim 12 wherein a plurality of vial cavities are provided in a vial block.